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Commentary

ROBERT RASCHE'S PAPER is divided into three parts. In the first part Rasche argues that many monetarist propositions have become widely accepted by macroeconomic theorists. With this I agree completely. The work of the so-called New Keynesians should really be called New Monetarist. Many of the papers in this tradition focus exclusively on the effect of monetary shocks. Moreover, the key building block for these papers is a quantity equation where velocity is treated as constant.

This is consistent with a basic monetarist tenet that money demand is pretty stable and changes in money represent mainly autonomous changes in money supply. The second part of Rasche's paper is concerned with bolstering the view that money demand, at least in some sense, has been stable over time. This is the part of the paper with which I disagree most.

The third part of the paper concerns vector autoregressions and the ambiguous role they give to monetary disturbances. Rasche argues that it is hard to identify the economic meaning of the residuals in these vector autoregressions. It is particularly hard to determine which residual or which combination of these residuals represents shocks to the money supply. Therefore it is difficult to use these particular statistical techniques for evaluating monetary policy. I am in basic agree-

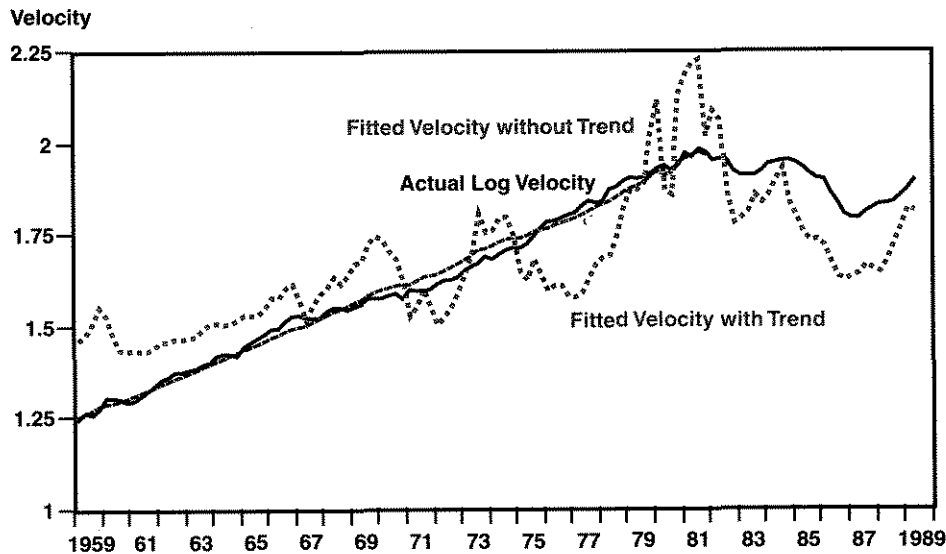
ment with this part of the paper, so when I discuss it, I will mainly elaborate on themes that Rasche develops.

Let me start with the issues raised by the second part of the paper. The Andersen-Jordan equation relates the change in nominal GNP to the change in money (measured by the monetary base) and changes in several measures of fiscal stance. Regressions of output on money are a basic staple of empirical macroeconomics today, and Andersen and Jordan deserve credit for pioneering regressions of this form. As Rasche emphasizes, such regressions really make sense only if you can think of monetary growth as representing an exogenous impulse. This requires among other things that money demand be stable. The instability of money demand has been researched at length. One apparent instability on which Rasche focuses is the change in velocity's trend around the early 1980s. He attributes this change to a change in interest rate trends. The implicit suggestion is that money demand is stable after all.

Rasche's view, which echoes Lucas (1988), is that there exists a stable, long-run money demand equation that can be estimated using levels of velocity and interest rates.¹ This cointegrating regression explains the trend in velocity with the trend of interest rates in the pre-1980

¹Lucas' data actually run from 1900, so he displays even more stability than reported here.

Figure 1
Actual and Fitted Velocity



period. I have rerun a similar equation using CITIBASE data from 1959:1 to 1989:2, and the results are as follows:

$$(1) \quad \log \left(\frac{GNP_t}{M1_t} \right) = 1.286 + 0.062i_t$$

(0.029) (0.004)

$$R^2 = 0.649 \quad D.W. = 0.18,$$

where i is the interest rate on Treasury bills. My estimated interest elasticity is a bit smaller than Rasche's, but the cointegration result is the same. To understand what is going on, it is helpful to look at figure 1, which shows the fitted values of this regression together with the actual values for the logarithm of velocity. We see that the fitted values match the trend in velocity rather well through the early 1980s. The ability of interest rates to account for the long-run movements in velocity is remarkable. I have to confess that the ability to track the trends in velocity is so amazing that I wanted to check whether the interest rate's regression coefficient was unchanged from the pre-1979 to the post-1979 period. I thus ran the following regression:

$$(2) \quad \log \left(\frac{GNP_t}{M1_t} \right) = 1.346 + 0.047i_t + 0.011d_t * i_t$$

(0.038) (0.008) (0.005)

$$R^2 = 0.665 \quad D.W. = 0.16,$$

where d_t represents a dummy variable that equals zero before 1979:1 and one afterwards. The coefficient on the interest rate is thus significantly higher in the second part of the sample. Therefore all stability problems should not be considered solved. Nonetheless, it is impressive that a single interest rate coefficient can track the trends in velocity.

The question at this point is whether Rasche has found *the* money demand equation. An alternative view is that the ability of interest rates to explain long-run trends in money is a coincidence and that economists should really search for a money demand equation that explains deviations around trends. In this view trends in money are caused by secular changes in regulation and technology, which have nothing to do with interest rates. Thus trends in interest rates and velocity are unreliable sources of information about the semi-elasticity of money demand with respect to interest rates.

On *a priori* grounds, one should prefer Rasche's interpretation because it doesn't rely on anything outside the model, such as regulatory changes and technical progress. And yet I must admit that I resist Rasche's view that he has found the true underlying money-demand function. I resist because I am bothered by the huge residuals in

this equation. The fitted values are often 20 percent or more away from the actual level of velocity. Moreover, these huge residuals aren't just random; they are strongly correlated with high-frequency movements in interest rates. Thus around 1975 when interest rates were relatively low, velocity was also predicted to be low. There must have been a huge reduction in money demand around this period to explain the actual behavior of velocity. Put differently, the medium- and high-frequency movements in interest rates, including the spike of 1979, must be attributed to large temporary changes in money demand. I find this hard to believe, however, and tend to trust the conventional wisdom that attributes many of these changes in interest rates to monetary policy. But to believe this conventional wisdom, you have to believe that the short-run interest elasticity of money demand is different from that estimated by the cointegrating regression. In other words, you have to believe that the cointegrating regression does not deliver *the* stable money demand curve that can be used for short-run policy analysis.

To see what difference this makes, I have rerun the regression explaining the log of velocity with interest rates through the end of 1981 but adding a trend. In other words, in this regression the trend is due to technical progress in credit cards and other advances that allow individuals to conserve on money balances. In figure 1 the fitted value with the trend is closer to the actual value than is the fitted value without the trend. Figure 1 supports Rasche's view that money demand is stable after all because it explains long-run swings but this stability is purchased at a heavy price. It must be that money demand is incredibly unstable at short and medium frequencies.

This comment just puts the shoe on the other foot because it raises the question of why money demand rose greatly (and velocity declined) in the early 1980s. Although I am far from having a complete explanation of this phenomenon, I want to return briefly to the theme I presented when I was here three years ago. I said then that simply adding monetary assets that pay different interest rates makes no sense and that procedures such as the Divisia method advocated by Barnett (1980) should be used instead. This seems particularly germane to the question of why velocity fell in the 1980s. The reason is that currency and non-interest-paying demand deposits

did not rise unprecedentedly in this period. Figure 2 shows the velocity of the aggregate that includes only these non-interest-bearing assets and it continues to trend upward. What did increase dramatically in this period is the holding of other checkable deposits that pay interest. But adding these to the rest is simply misleading. Other checkable deposits are much more attractive as savings instruments than the other components of M1, so they should be regarded as less monetary.

Exactly how much less monetary than other checkable deposits is perhaps a matter of debate. For current purposes, let me propose that they are about one-third as monetary as the other ingredients in M1, so a proper aggregate can be constructed by adding one-third of other checkable deposits to the other two monetary components.² The logic behind this is as follows. In the late 1980s the Treasury bill rate used by Rasche averaged about 7 percent, and interest rates on other checkable deposits were between 4 percent and 5 percent. Thus the gap between these two interest rates is about one-third of the gap between the interest rate on currency and that on Treasury bills. Figure 2 displays the result of treating other checkable deposits as being one-third as monetary as the other assets. Little change in trend can now be detected.

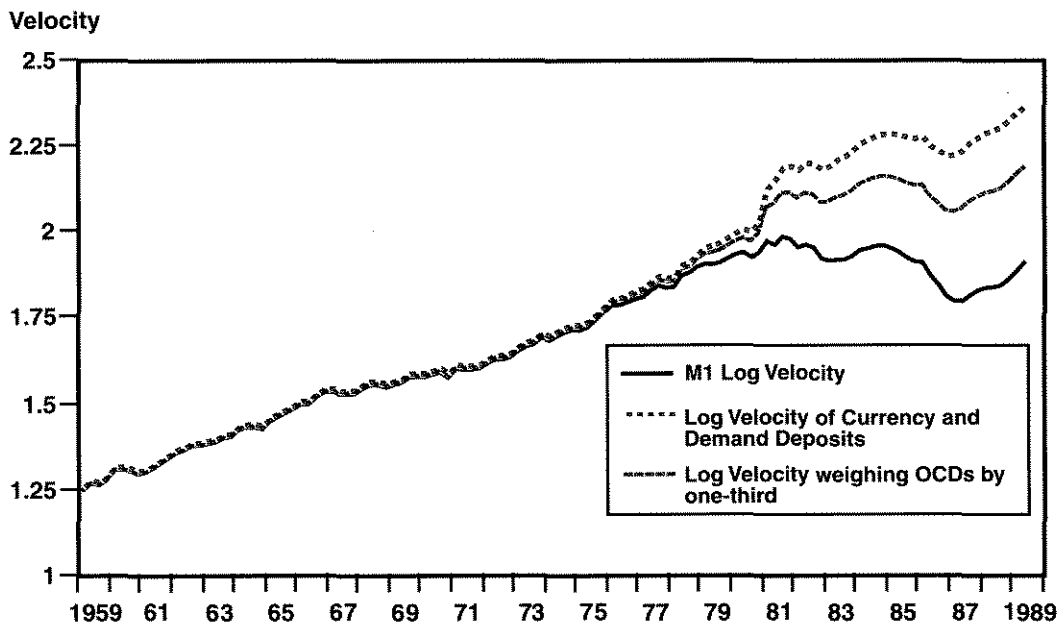
The exercise I just finished is hopelessly crude, and I am not really trying to push the idea that the velocity trend is a natural constant. Rather I am trying to say that the remarkable fit of the Rasche regression explaining velocity should be taken with a grain of salt. There are other plausible reasons for velocity to have fallen in the 1980s.

In conclusion, even if Rasche's regression gives us the true money-demand relation, the volatility of velocity is substantial. This makes a rule where money grows at a constant rate unattractive relative to a rule where monetary changes track changes in velocity. This raises the following two related questions. How do you ascertain that the Fed has done a good job of accommodating changes in velocity, and how do you measure actual monetary impulses over and above those needed to satisfy changes in money demand?

I agree with Rasche's basic thrust that a purely statistical approach cannot disentangle the endogenous and exogenous parts of changes in

²See Rotemberg, Driscoll and Poterba (1992) for a more detailed analysis.

Figure 2
The Velocity of Different Aggregates



money. It is hard to know exactly what is being captured by innovations in money within typical VARs. I am particularly bothered by the inconsistency between regressions of various variables on money and money innovations on the one hand and regressions that use variables that reflect changes in Federal Reserve intentions on the other.

In the case of regressions that use money and money innovations on the right-hand side, one generally finds that money raises output and interest rates. Over the years, several authors have constructed variables on the basis of the FOMC minutes that are supposed to reflect Federal Reserve intentions. Boschen and Mills (1992) show that all these proxies have similar correlations with subsequent levels of GNP and interest rates. In particular, after the proxies indicate that the Fed wishes to tighten, output falls while interest rates rise. These opposite reactions of output and interest rates are quite consistent with textbook models and it is inconsistent with the simultaneous increase in output and interest rates that tends to follow increases in money. So how can one reconcile regressions

on proxies of Fed intentions on the one hand and regressions on money growth on the other?

One feature of the U.S. postwar period is that many of the well-known episodes of changes in Fed policy involve deliberate tightening to slow inflation.³ Thus the historical evidence appears consistent with the asymmetries found by Cover (1992) and De Long and Summers (1988). These authors find that output is much more strongly correlated with negative monetary innovations than with positive ones. The latter have a small positive effect on output that is statistically insignificant.

De Long and Summers construct their innovations by running the following regression:

$$(3) \Delta \log M1_t = 0.005 + 0.457 \Delta \log M1_{t-1} - \\ (0.002) \quad (0.091) \\ 0.145 \Delta \log GNP_{t-1} + 6e-5 \text{Trend} \\ (0.083) \quad (2e-5) \\ R^2 = 0.321 \quad D.W. = 1.93$$

The residuals of this regression can be used to construct DM^n , which equals the smaller of the residual and zero. Thus this variable captures

³See Romer and Romer (1989).

negative innovations. As a further analysis of asymmetries, I considered a regression of the Treasury bill rate on changes in money and on DM^n over the period 1960:3-1989:2. The results are as follows:

$$(4) \quad i_t = \begin{matrix} -0.04 & + & 1.31i_{t-1} & - & 0.68i_{t-2} & + & 0.72i_{t-3} & - & 0.5i_{t-4} \\ (0.198) & & (0.088) & & (0.151) & & (0.166) & & (0.106) \end{matrix}$$

$$+ \begin{matrix} 51.4DM_{t-1} & + & 4.9DM_{t-2} & + & 3.4DM_{t-3} & - & 12.8DM_{t-4} \\ (15) & & (18) & & (17) & & (14) \end{matrix}$$

$$- \begin{matrix} 75.0DM_{t-1}^n & - & 10.0DM_{t-2}^n & + & 8.2DM_{t-3}^n & - & 52.7DM_{t-4}^n \\ (25) & & (27) & & (25) & & (22) \end{matrix}$$

$$R^2 = 0.944 \quad D.W. = 2.13,$$

where DM represents the change in the logarithm of $M1$.

We see here that, as in typical VARs, lagged changes in money tend to increase interest rates. But on the other hand, the effect of lagged negative monetary innovations is negative. This means that negative monetary innovations actually raise interest rates; they have the same correlation with interest rates as the proxies that indicate that the Fed wishes to tighten.⁴ Combining these results with those of Cover and those of De Long and Summers, I conclude that negative monetary innovations affect the economy as money supply shocks should, whereas positive shocks do not.

How should you interpret the positive innovations in money in light of their correlation with GNP and the Treasury bill rate? One cannot say that they represent simply monetary accommodation to increases in the stochastic component of the demand for money. Given that these innovations lead to rises in interest rates, the accommodation can be only partial. But partial accommodation of money-demand disturbances should lead to declines rather than small increases in output. I am thus inclined to believe that these positive innovations in money represent in part accommodation by the Fed of other shocks whose effect is to increase future output. Thus the Fed is accommodating increases in money demand that are due to increases in output rather than mere

money-demand disturbances. If this is true, it suggests that the Fed is sometimes farsighted.

These results can be used to discuss an alternative explanation of the asymmetries found by Cover and by De Long and Summers. This alternative view holds that all monetary innovations represent exogenous increases in the money supply but that the effects of changes in the money supply are intrinsically asymmetric. The traditional analogy is that monetary policy operates like a string and that strings are useful only for pulling the economy down, not for pushing it up. Several theories of such asymmetries have been proposed. One cause of this structural asymmetry could be that reductions in reserves force banks to cut loans, whereas banks can react to an increase in reserves by raising their holding of securities. If investment depends on the supply of loans and not on the interest rate and the supply of loans is affected only by monetary contractions, then only money-supply reductions have a powerful effect on the economy. Another possible cause of this asymmetry is discussed by Caballero and Engel (1992) who show that asymmetry is a natural consequence of the steady-state distribution of prices in an economy with costs of price adjustment.

Both of the preceding hypotheses may well be able to explain the asymmetry found by Cover and by De Long and Summers. They cannot, however, explain the asymmetric effect on interest rates as easily. The asymmetric response of interest rates casts doubt on the hypotheses by showing that the effects are asymmetric even in securities markets, not just in markets subject to frictions (for example, the market in which banks intermediate loans to businesses and the markets in which firms set prices that are relatively rigid).

As Robert Rasche emphasizes, there is still much to be done to understand the precise role of monetary innovations in statistical models. To understand this role, we have to connect money innovations with other historical and institutional data. Only then can we ascertain the empirical importance of money-supply disturbances in the economy.

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⁴I also checked whether I could detect asymmetric effects on inflation (to see whether the asymmetric effects on interest

rates represent asymmetric effects on real returns as well). Inflation does not appear to respond asymmetrically.

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